

**NEAR INFRARED RAY ABSORBING LAMINATED PLATE, ITS MANUFACTURE,  
AND PLASMA DISPLAY FRONT SHEET USING IT**

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**Abstract of JP10282335**

**PROBLEM TO BE SOLVED:** To provide a near infrared ray absorbing laminated plate which is especially suitable for a front sheet of a plasma display, excellent in the abrasion resistance and shock resistance, excellent in humidity resistance, transparent in the visible range, and having the absorption performance of the light of the wavelength in the near infrared ray range. **SOLUTION:** In a near infrared rays absorbing laminated plate, the polymer of the composition containing (a) a monomer having an unsaturated double bond, (b) a compound containing a phosphor atom which is indicated by the following formula  $(\text{HO})_n - \text{P}(\text{O}) - (\text{OR})_{3-n}$ , where R is the alkyl group, allyl group, aralkyl group, alkenyl group having a 1-18C RO indicates the polyoxyalkyl group, (meta)acryloyloxyalkyl group, or (meta)acryloilpolyoxyalkyl group having a 4-100C, and (n) indicates 1 or 2, and (c) the compound containing copper atom, is interposed between a plurality of transparent sheets.

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(54) NEAR INFRARED RAY ABSORBING LAMINATED PLATE, ITS MANUFACTURE, AND PLASMA DISPLAY FRONT SHEET USING IT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a near infrared ray absorbing laminated plate which is especially suitable for a front sheet of a plasma display, excellent in the abrasion resistance and shock resistance, excellent in humidity resistance, transparent in the visible range, and having the absorption performance of the light of the wavelength in the near infrared ray range.

SOLUTION: In a near infrared rays absorbing laminated plate, the polymer of the composition containing (a) a monomer having an unsaturated double bond, (b) a compound containing a phosphor atom which is indicated by the following formula  $(\text{HO})_n\text{-P}(\text{O})\text{-(OR)}_{3-n}$ , where R is the alkyl group, allyl group, aralkyl group, alkenyl group having a 1-18C RO indicates the polyoxyalkyl group, (meta)acryloyloxyalkyl group, or (meta)acryloilpolyoxyalkyl group having a 4-100C, and (n) indicates 1 or 2, and (c) the compound containing copper atom, is interposed between a plurality of transparent sheets.

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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The near infrared ray absorption laminate characterized by making the polymer of the constituent containing following component (a) - (c) intervene among two or more transparence plates.

(a) Monomer (b) general formula which has a partial saturation double bond The Lynn atom content compound shown by -izing 1 [\*\* 1] (HO) n-P(O)-(OR)<sub>3-n</sub> (the inside of a formula, and R -- the alkyl group of carbon numbers 1-18, an aryl group, an aralkyl radical, and an alkenyl radical -- or RO expresses the polyoxy alkyl group of carbon numbers 4-100, a (meth)acryloyloxy alkyl group, and an acryloyl (meta) polyoxy alkyl group, and n expresses 1 or 2)

(c) Copper atom content compound [claim 2] RO of the Lynn atom content compound -- general formula -izing 2 -- [Formula 2] The near infrared ray absorption laminate according to claim 1 which is the (meth)acryloyloxy alkyl group or (meta) acryloyl polyoxy alkyl group shown by CH<sub>2</sub>=C(X) COO (Y) m- (a hydrogen atom or a methyl group, and Y express the oxy-alkylene group of carbon numbers 2-4 with a number average, and X expresses 1-20 among a formula, as for m).

[Claim 3] The near infrared ray absorption laminate according to claim 1 whose transparence plate is glass.

[Claim 4] The near-infrared absorption laminate according to claim 1 whose average light transmission whose average light transmission with a wavelength of 450nm - 650nm is 50% or more and the wavelength of 800nm - 1000nm is 30% or less.

[Claim 5] The manufacture approach of the near infrared ray absorption laminate according to claim 1 which a gasket is made to be placed between the perimeters between at least two transparence plates which counter, and carries out [ mold clamp ] of the periphery enclosure, is made to form a cel with an opening, pours in the constituent which contains according to claim 1 component (a) - (c) in this opening, and is characterized by carrying out a polymerization.

[Claim 6] The front-face plate of a plasma display which consists of a near infrared ray absorption laminate according to claim 1.

[Claim 7] The front-face plate of a plasma display according to claim 6 whose transparence plate is glass which has conductivity on the front face.

[Claim 8] The front-face plate of a plasma display according to claim 6 which has an acid-resisting layer on a front face.

[Claim 9] The front-face plate of a plasma display according to claim 6 which has a pollution-control layer on a front face.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

[Field of the Invention] This invention relates to the near infrared ray absorption laminate excellent in shock resistance, abrasion-proof nature, and moisture resistance, and its manufacturing method. Furthermore, it is related with this front-face plate for near infrared ray absorption laminates of a \*\*\*\* plasma display.

**[0002]**

[Description of the Prior Art] The resin plate and glass ingredient which absorb the wavelength light of a near infrared ray field are used as a charge of a heat ray absorber as a light filter, and various things are already proposed.

[0003] The organic compound containing a divalent copper ion be convert into the weight of a copper ion to the methacrylic tree 100 weight section chose as JP,62-5190,B and JP,63-31512,B from the methacrylic system polymer containing 50 % of the weight or more in the polymethyl methacrylate or the methyl methacrylate unit as a resin plate , for example , and the methacrylic resin ingredient which be excellent in the solar radiation absorbing power which make it come to contain the phosphorus compounds of 0.01 - 5 weight section and specific structure etc. be propose .

[0004] Moreover, the light filter characterized by coming to contain the metal salt which uses as a principal component the copolymer obtained by copolymerizing the mixed monomer which becomes JP,6-118228,A from the phosphoric-acid radical content monomer of specific structure and the monomer in which this and copolymerization are possible, and copper salt is proposed.

[0005] Furthermore as a glass ingredient, the near infrared ray absorption glass which consists of phosphate glass which contained the copper ion in JP,62-128943,A, JP,4-214043,A, and JP,4-55136,B is proposed.

[0006] Moreover, it is the objects, such as the object which prevents the indistinctness of the image by an echo and background of the illumination light being reflected as a front plate of a display unit, and protection of a display front face, dirt prevention on the front face of a display, and various things with acid resistibility, abrasion-proof nature, and antifouling property are proposed. However, the plasma display has emitted the so-called beam of light of a near infrared ray field with a wavelength [ not only the light but ] of 800nm - 1100nm. On the other hand, the beam of light of a near infrared region is used also for remote-control systems, such as TV for home use and VTR, and the data communication between computers. With the beam of light of the near infrared ray field \*\*\*\*(ed) from this display unit, a failure may be done to the remote-control system and data communication of these devices. Furthermore, in addition to this, a device is sometimes influenced [ FM broadcasting of the circumference by the electromagnetic wave generated from the screen and perimeter of a plasma display, or ]. The approach of using the fiber reticulum by which the front face of a filament was metalized for JP,6-91340,B as an approach of covering the electromagnetic wave of a display is proposed.

**[0007]**

[Problem(s) to be Solved by the Invention] Near infrared ray absorptance is not enough, and an ingredient given in above-mentioned JP,62-5190,B and JP,63-31512,B has large hygroscopicity, and when it is used under a high humidity ambient atmosphere, it is easy to devitrify it. Although near infrared ray absorptance is enough, an ingredient given in JP,6-118228,A is not desirable when [such as having the process which extracts an acid component, / industrial] manufacturing, in order to be easy to devitrify when hygroscopicity uses it under a high humidity ambient atmosphere greatly, and to prevent it. Furthermore, each of these ingredients is resin, and since they are inferior to abrasion-proof nature, they also have troubles -- if it is used as grading ingredients, such as an aperture, it will be easy to get damaged.

[0008] Moreover, for a blemish, near infrared ray absorption glass given in JP,62-128943,A, JP,4-214043,A, and JP,4-55136,A is a crack and a cone, when it is inferior to shock resistance and a body collides, although it was hard to attach. Moreover, all have large hygroscopicity, and it is easy to devitrify when it is used under a high humidity ambient atmosphere.

[0009] The above-mentioned charge of a near infrared ray absorber is unsuitable as abrasion-proof nature, shock resistance, and a front plate of a damp-proof field to a display. With the front-face plate of a display with the acid resistibility by which the conventional proposal is furthermore made, abrasion-proof nature, and antifouling property, the electromagnetic wave which cannot prevent the remote-control system or data communication failure by the near infrared ray, and is generated from screen \*\*\*\*\* cannot be covered, either. Moreover, the approach of using the fiber reticulum by which the front face of a filament was metalized has problems, such as moiré generating and lowering of visibility, although the electromagnetic wave electric shielding engine performance is extremely excellent.

[0010] Then, as a result of excelling in near-infrared absorbing power and examining wholeheartedly the high charge of a near infrared ray absorber abrasion-proof nature, shock-proof, and damp-proof, this invention person has the near infrared ray absorbing power excellent in the laminate which made the polymer of the constituent containing the monomer mixture, the Lynn atom content compound of specific structure, and the copper atom content compound which have a partial-saturation double bond intervene between transparence plates, found out that shock resistance, abrasion-proof nature, and moisture resistance were also high, and resulted in this invention. Moreover, when this near infrared ray absorption laminate was used as a front-face plate of a plasma display, it resulted that the front plate excellent in near infrared ray electric shielding nature was obtained in a header and this invention.

[0011]

[Means for Solving the Problem] That is, this invention is a front-face plate of a plasma display which comes to use the near infrared ray absorption laminate characterized by making the polymer of the constituent containing following component (a) - (c) intervene among two or more transparence plates, its manufacture approach, and it.

(a) Monomer mixture (b) general formula which has a partial saturation double bond The Lynn atom content compound shown by-izing 3 [\*\* 3] (HO) n-P(O)-(OR)<sub>3</sub>-n (the inside of a formula, and R -- the alkyl group of carbon numbers 1-18, an aryl group, an aralkyl radical, and an alkenyl radical -- or RO expresses the polyoxy alkyl group of carbon numbers 4-100, a (meth)acryloyloxy alkyl group, and an acryloyl (meta) polyoxy alkyl group, and n expresses 1 or 2)

(c) Copper atom content compound [0012]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail. With the transparence plate in this invention, synthetic-resin plates, such as cellulose type resin, such as a glass plate or acrylic resin, polycarbonate system resin, polyester resin, triacetyl cellulose, and diacetyl cellulose, and styrene resin, are mentioned. The plate which added a light diffusion agent, a coloring agent, a release agent, a stabilizer, the ultraviolet ray absorbent, the antioxidant, the antistatic agent, the flameproofing agent, etc. if needed may be used. A monolayer is sufficient as a transparence plate and what carried out the laminating of the plurality is sufficient as it. Moreover, with a resin plate, in order to raise surface hardness and to raise abrasion-proof nature, what formed the rebound ace court layer in the front face by the well-known approach can be used.

[0013] Especially, the glass plate is excellent in abrasion-proof nature, and desirable. As a glass plate

here, well-known various glass plates, such as a glass plate strengthened chemically and thermally besides a common glass plate, a wired glass plate, a glass plate with which acid-resisting processing was performed to the front face, and a glass plate which gave conductivity to the front face, can be used. [0014] It is shown that the publication with the acrylate in this invention (meta) is acrylate or methacrylate.

[0015] The monomer which has the partial saturation double bond which is the (a) component in this invention is a monomer of monofunctional [ which has the partial saturation double bond in which a radical polymerization is possible in / at least one / a molecule ], or many organic functions, and it will not be limited especially if a transparent polymer is obtained in a light field.

[0016] As a monofunctional monomer, for example Methyl (meta) acrylate, ethyl (meta) acrylate, Propyl (meta) acrylate, n-butyl (meta) acrylate, Isobutyl (meta) acrylate, t-butyl (meta) acrylate, 2-ethylhexyl (meta) acrylate, isodecyl (meta) acrylate, The acrylic ester which has a straight chain or branching alkyl groups, such as n-lauryl (meta) acrylate and n-stearyl (meta) acrylate, (meta); Bornyl (meta) acrylate, Feng Chill (meta) acrylate, 1-menthyl (meta) acrylate, Adamanthyl (meta) acrylate, dimethyl adamantyl (meta) acrylate, Cyclohexyl (meta) acrylate, isobornyl (meta) acrylate, Tricyclo [5.2.1.0<sup>2,6</sup>] deca-8-IRU = (meta) acrylate, The acrylic ester which has alicyclic hydrocarbon radicals, such as JISHIKURO pentenyl (meta) acrylate, (meta); Allyl compound (meta) acrylate, Alkenyl radicals, such as benzyl (meta) acrylate and naphthyl (meta) acrylate, The acrylic ester which has an aralkyl radical and an aryl group (meta); Styrene, Styrene monomers, such as alpha methyl styrene, vinyltoluene KURORU styrene, and bromine styrene; (meta) An acrylic acid, Unsaturated carboxylic acid, such as a maleic acid and an itaconic acid; A maleic anhydride, Acid anhydrides, such as itaconic acid anhydride; 2-hydroxyethyl (meta) acrylate, 2-hydroxypropyl (meta) acrylate, tetrahydrofurfuryl (meta) acrylate, Hydroxyl content monomers, such as mono-glycerol (meta) acrylate; Acrylamide, Methacrylamide, acrylonitrile, a methacrylonitrile, diacetone acrylamide, Nitrogen content monomers, such as dimethylaminoethyl methacrylate; The allyl compound GURIJI sill ether, Epoxy group content monomers, such as GURIJISHIRU (meta) acrylate; Polyethylene-glycol monochrome (meta) acrylate, Alkylene oxide radical content monomers, such as polypropylene-glycol monochrome (meta) acrylate and polyethylene-glycol monoallyl ether; although the monomer of others, such as vinyl acetate, a vinyl chloride, a vinylidene chloride, fluoridation vinylidene, and ethylene, etc. is mentioned There is nothing what is limited to especially these.

[0017] As a polyfunctional monomer, 1, 4-butane JIORUJI (meta) acrylate, Alkyl JIORUJI (meta) acrylate, such as neopentyl GURIKORUJI (meta) acrylate; Ethylene GURIKORUJI (meta) acrylate, Alkylene (Pori) GURIKORUJI (meta) acrylate, such as tetra-ethylene GURIKORUJI (meta) acrylate and tetrapropylene glycol diacrylate; A divinylbenzene, Aromatic series multifunctional compounds, such as diallyl phthalate; Pentaerythritol tetrapod (meta) acrylate, The acrylic ester (meta) of polyhydric alcohol, such as TORIMECHI roll pro pantry (meta) acrylate; Urethane (meta) acrylate, Although the acrylate (meta) of high molecular compounds, such as polyester (meta) acrylate and polyether (meta) acrylate, is mentioned, it is not limited to especially these.

[0018] in order to raise the adhesive property of a transparence plate and the resin layer made to intervene -- the inside of a monomer -- the partial saturation of an acrylic acid, a methacrylic acid, etc. -- it is desirable to add acids. When using a glass plate as a transparence plate, a well-known coupling agent etc. is made to exist for the purpose of heightening adhesive strength with glass, and a polymerization may be carried out.

[0019] the Lynn atom content compound which is the (b) component in this invention -- general formula although it is what is shown by-izing 3 -- general formula RO under-izing 3 -- general formula -izing 4 - - [Formula 4] it is desirable from the Lynn atom content compound which is the (meth)acryloyloxy alkyl group or (meta) acryloyl polyoxy alkyl group shown by  $\text{CH}_2=\text{C}(\text{X})\text{COO}(\text{Y})\text{m}$ - (the inside of a formula and X -- m expresses [ a hydrogen atom or a methyl group ] 1-20 with a number average for the oxy-alkylene group of carbon numbers 2-4 in Y) serving as a copolymerization component of a polymer, and the reinforcement of the laminate obtained becoming large.

[0020] As a Lynn atom content compound, monoethyl phosphate, diethyl phosphate, Monobutyl

phosphate, dibutyl phosphate, mono-hexyl phosphate, Dihexyl phosphate, mono-heptyl phosphate, diheptyl phosphate, Mono-octyl phosphate, dioctyl phosphate, mono-lauryl phosphate, Dilauryl phosphate, mono-stearyl phosphate, distearyl phosphate, Monod 2-ethylhexyl phosphate and G 2-ethylhexyl -- phosphate -- \*\* -- alkyl phosphate; monophenyl phosphate -- Aryl phosphate, such as diphenyl phosphate; Monochrome (nonylphenyl) phosphate, Aralkyl phosphate, such as screw (nonylphenyl) phosphate; Monoallyl phosphate, alkenyl phosphate [, such as diaryl phosphate, ]; -- polyoxy alkyl phosphate [, such as polyethylene-glycol phosphate ]; (meta) -- acryloyloxyethyl phosphate -- Screw [(meta) acryloyloxyethyl] phosphate, acryloyloxypropyl (meta) phosphate, (meth) acryloyloxy alkyl phosphate, such as screw [(meta) acryloyloxypropyl] phosphate; (meta) Acryloyl polyoxy ethyl phosphate, (Meta) Acryloyl (meta) polyoxy alkyl phosphate, such as acryloyl polyoxy propyl phosphate, etc. is mentioned. In addition, two or more sorts of above-mentioned Lynn atom content compounds can be used together.

[0021] The amount of the Lynn atom content compound used is 0.1 - 50 weight section to the (a) component 100 weight section, and is 0.5 - 30 weight section preferably. If there is less amount of the Lynn atom content compound used than the 0.1 weight section, good near infrared ray absorbing power cannot be acquired. Moreover, the reinforcement of the laminate which will be obtained if 50 weight sections are exceeded falls, and it is not desirable.

[0022] As a compound containing the copper atom which is the (c) component in this invention, if the copper atom is contained, there is especially no limit and it can use various things. For example, the salt of carboxylic acids, such as copper acetate, formic-acid copper, propionic-acid copper, the Valerin \*\*\*\*, hexanoic-acid copper, octylic acid copper, decanoic-acid copper, lauric-acid copper, stearin acid copper, 2-ethylhexanoic acid copper, copper naphthenate, benzoic-acid copper, and cupric citrate, and a copper ion, an acetylacetone or an acetoacetic acid, the complex salt of a copper ion, a copper chloride, copper pyrophosphate, copper hydroxide, etc. can be used.

[0023] the amount of the copper atom content compound used -- the (a) component 100 weight section - - receiving -- 0.01 - 30 weight section -- it is 0.1 - 20 weight section still more preferably. If there is less amount used than the 0.01 weight section, good near infrared ray absorbing power cannot be acquired. Moreover, since the transparency in the light of the resin which will be obtained if 30 weight sections are exceeded is spoiled, it is not desirable. In addition, for this amount, the Lynn atom content compound is equivalent to 0.05-10 mols to one mol of copper atom content compounds.

[0024] As an approach of making it intervene among two or more transparence plates, the polymer of the constituent which consists of above-mentioned component (a) - (c) Make a gasket placed between the perimeters between at least two transparence plates which counter, carry out [ mold clamp ] of the periphery enclosure, a cel with an opening is made to form, the constituent which consists of component (a) - (c) in this opening is poured in, and the approach of carrying out a polymerization has the strong adhesive strength of a transparence plate and a polymer, and is desirable.

[0025] In this approach, although there are two transparence plates made to counter, they may usually be three or more sheets if needed. It is a thing based on the cel cast method of the common knowledge which manufactures the so-called acrylic resin plate to make a gasket placed between the perimeters between transparence plates, to mold clamp carry out of the periphery enclosure, and to make an opening form, and it changes to the glass which forms a cel and applies a transparence plate.

[0026] A gasket has rubber elasticity, and stops the leakage of the constituent which consists of above-mentioned component (a) - (c) poured in into an opening, and the thickness responds to the thickness of the polymer formed by carrying out a polymerization in an opening. Generally thickness is 0.01mm - about 20mm.

[0027] The constituent to pour in dissolves (c) copper atom content compound, a well-known polymerization initiator, etc. in the mixture of the monomer which has the partial saturation double bond which is the (a) component, and the Lynn atom content compound which is the (b) component, or the so-called syrup which contains a polymer in part. It is desirable beforehand deaeration and to carry out degassing and to pour in this constituent into the opening of a cel.

[0028] The polymerization of this constituent carries out heating temperature up of the cel, or irradiates



ultraviolet rays or a radiation and performs it in a cel. The approach of heating the approach in the case of heating using heating elements heated with infrared radiation etc. the inside of a hot-air-drying furnace and among warm water, such as an approach and a nichrome wire, is mentioned. It not only carries out with constant temperature, but the range of polymerization temperature is 0 degree C - 150 degrees C in general, and you may change it continuously or gradually. When irradiating ultraviolet rays or a radiation, sufficient dosage for hardening is irradiated from the outside of a cel using a high-pressure mercury-vapor lamp, a metal halide lamp, etc.

[0029] Moreover, as other methods of obtaining a near infrared ray absorption laminate, the polymerization of the constituent which consists of component (a) - (c) beforehand is carried out, the polymer is made into the shape of a sheet, it inserts among two or more transparence plates, and there is the approach of carrying out thermocompression bonding of this using the inside of an autoclave, a roll, and a press. As an approach of obtaining the polymer of the shape of a sheet of the constituent which consists of component [ in this case ] (a) - (c), the following approach is mentioned, for example.

(1) How to blend the Lynn atomic compound of a component (b), and the copper atom content compound of a component (c) with homogeneity, and fabricate them in the shape of a sheet by the well-known melting kneading approach, to the polymer of the shape of a powder acquired according to the bulk polymerization of a component (a), a suspension polymerization, an emulsion polymerization, etc.  
 (2) How to blend with homogeneity and fabricate in the shape of a sheet by the melting kneading approach of common knowledge of the (c) component, to a copolymer with acryloyloxyethyl phosphate etc. as powder-like a component (a) and a component (b) (meta).  
 (3) the mixture of the monomer which has the partial saturation double bond of a component (a), and the Lynn atom content compound which is a component (b), or a part -- the approach of injecting the solution which dissolved (c) copper atom content compound, the well-known polymerization initiator, etc. in the so-called syrup containing a polymer into the cel which does not have a polymer and an adhesive property, performing a polymerization by heat or light, and taking out a tabular polymer from a cel.

[0030] The near infrared ray absorption laminate of this invention is suitably used as a front plate installed in the front face of plasma display equipment. The magnitude of a front plate can be chosen as arbitration according to the screen size of plasma display equipment. Moreover, although thickness can also be chosen as arbitration, it is about 0.01-10mm in general.

[0031] Average light transmission with a wavelength [ of this front plate ] of 450nm - 650nm is 60% or more preferably 50% or more. If lower than 50%, the image of plasma display equipment stops being able to be visible easily, and it is not desirable. Moreover, average light transmission with a wavelength of 800nm - 1000nm is 20% or less preferably 30% or less. If higher than 30%, the near infrared ray from plasma display equipment cannot be covered, but it will have an adverse effect on a surrounding remote control device etc.

[0032] In case the near infrared ray absorption laminate of this invention is used as a front plate, an electromagnetic wave shielding layer, an acid-resisting layer, and a pollution-control layer may be formed the front face or into a near infrared ray absorption laminate by the case.

[0033] Various well-known things can be used by what an electromagnetic wave shielding layer is a conductive layer which raised surface electrical conductivity, for example, carried out the laminating of the conductive metallic oxide, such as metals, such as platinum, gold, silver, and palladium, tin oxide, and indium oxide, by approaches, such as plating, vacuum evaporatio, and sputtering, the thing which coated conductive coating material, the thing in which the thin layer of a conductive polymer was made to form. As for conductivity, as a transparence plate used for a near infrared ray absorption laminate, what carried out the laminating of a metal and the conductive metallic oxide to the glass front face by approaches, such as plating, vacuum evaporatio, and sputtering, is highly desirable. In surface resistivity, below 1000ohms / \*\* are desirable still more desirable, and the conductivity in this case is below 100ohms / \*\*.

[0034] An acid-resisting layer can be given to the front face, when direct is formed in the front face of a near infrared ray absorption laminate and it forms an electromagnetic wave shielding layer in a front



face. Although it is well-known as an acid-resisting layer and there is no definition in profit, it becomes JP,4-338901,A, JP,64-86101,A, and JP,56-113101,A from the monolayer or the multilayer thin film of the inorganic oxide of a publication, and an inorganic halogenide, and the thing formed by well-known approaches, such as vacuum evaporation technique, the ion plating method, and the sputtering method, or the thin layer which becomes JP,7-151904,A from the fluorine polymer of a publication is mentioned, for example.

[0035] A pollution-control layer can be given on the surface of \*\*\*\*, when direct is formed in the front face of a near infrared ray absorption laminate and it forms an electromagnetic wave shielding layer and an acid-resisting layer in a front face. Although it is well-known as a pollution-control layer and there is especially no definition, the pollution-control layer which becomes JP,3-266801,A, JP,6-29332,B, and JP,6-256756,A from the fluorine of a publication and a siloxane content compound is mentioned, for example.

[0036] An electromagnetic wave shielding layer, an acid-resisting layer, and a pollution-control layer may be directly formed in a near infrared ray absorption laminate front face, and may paste together the sheet or film with which those layers were formed on a front face. An electromagnetic wave shielding layer layer, an acid-resisting layer, and a pollution-control layer are chosen suitably, and are formed in both sides or one side of a near infrared ray absorption laminate if needed. Moreover, the sequence that these layers are formed is also chosen suitably if needed.

[0037]

[Effect of the Invention] The near infrared ray absorption laminate of this invention has good abrasion-proof nature and shock resistance, is excellent in moisture resistance, has the wavelength absorption-of-light engine performance of transparency and a near infrared ray field, and can use it suitably in a visible range as light filters, such as color correction and visibility amendment, and a heat ray absorption grading ingredient. By furthermore using the near infrared ray laminate of this invention for the front-face plate of a plasma display, the near infrared ray emitted from a plasma display is covered, and the effect on a peripheral device etc. can be prevented.

[0038]

[Example] Hereafter, although an example explains this invention in more detail, this invention is not restricted at all by these examples. In addition, assessment was performed by the following approach.

- (1) Light transmission : the spectral transmittance of the range of 400nm - 1000nm wavelength of the obtained sample was measured using the Hitachi recording spectrophotometer U3410 mold.
- (2) Abrasion-proof nature : the obtained sample front face was ground against steel wool, the blemish was attached, and condition was checked visually.
- (3) Shock resistance : sequential drop of the \*\*\*\*\* of the amount of Sadashige Tokoro was carried out from predetermined height with the same test piece until it started the sample in 150mmx150mm magnitude, it placed on the 130mmx130mm frame and the test piece fractured, and the weight and the height of a shot when a test piece fractures were shown. The weight of a shot is 200g, 500g, and 1000g, and height is 300mm, 500mm, 700mm, 900mm, and 1200mm respectively.
- (4) Moisture resistance : the appearance after carrying out 1hr immersion of the obtained sample ebullition underwater was observed visually.
- (5) Visibility : the color of the image before attaching, seeing through and attaching the front plate obtained in the front face of a 21 inch plasma display, and the difference with a profile were checked.
- (6) Electromagnetic wave shielding ability : it evaluated using the shielding ingredient evaluation-system R2547 mold (ADVANTEST Make).
- (7) Remote control trial : the plasma display equipment PDSby FUJITSU GENERAL, LTD. 1000 mold which installed the front plate was put on the 15 slanting front of home use TV, and a location with a distance of 10m, and the image was displayed on them. A remote control signal (950nm of signal wave length) is sent to home use TV from the 15 opposite hand slanting front of home use TV, and a location with a distance of 3m, it checks whether a normal reaction is carried out, plasma display equipment is brought close to home use TV, and the distance which will not carry out a normal reaction was measured. When the near infrared ray generated from a display unit cannot be covered, a failure is

caused to remote control, and it does not react to it, or malfunction is caused. The remote control failure prevention function is excellent, so that the distance which will not carry out a normal reaction is short. [0039] The example 1 hydroxypropyl acrylate 50 weight section, the methacrylic-acid 5 weight section, the polyethylene-glycol-dimethacrylate (NK ester 23G, product made from New Nakamura Chemistry) 30 weight section, the following chemical formula 15 weight sections were mixed for the Lynn atom content compound shown by 6 weight sections and \*\* 6 in the Lynn atom content compound shown by-izing 5. Furthermore, the t-butylperoxy-2-ethylhexanoate 0.3 weight section was dissolved as the copper hydroxide 2.5 weight section and a radical polymerization initiator, and the constituent was obtained. It was left for 10 minutes under reduced pressure of this constituent, and degassing was performed. This constituent was injected into the cel which consists of a gasket made from a polyvinyl chloride with a thickness of 2mm, and two float plate glass (2mm in the Nippon Sheet Glass make, 620mmx420mm, thickness), the heating polymerization was carried out at 100 degrees C by 50 degrees C within hot air drying equipment for 2 hours for 12 hours, the polymerization of the mixture was carried out, and the near infrared ray absorption laminate of the three-tiered structure of glass / resin / glass was obtained. The assessment result was shown in tables 1 and 2. Moreover, the front face of a plasma display was equipped with this near infrared ray absorption laminate as it was. The assessment result as a front plate was shown in tables 3 and 4.

[0040]

[Formula 5]  $\text{CH}_2=\text{C}(\text{CH}_3) \text{COO}-\text{CH}_2\text{CH}(\text{CH}_3) \text{O}-\text{P}(\text{O}) \text{ and } (\text{OH})$  -- two [0041]

[Formula 6]  $[\text{CH}_2=\text{C}(\text{CH}_3) \text{COO}-\text{CH}_2\text{CH}(\text{CH}_3) \text{O-}]_2\text{P}(\text{O})-\text{OH}$  [0042] In example 2 example 1, it replaced with the hydroxypropyl acrylate 50 weight section, and except having used the hydroxypropyl acrylate 25 weight section and the n-butyl methacrylate 25 weight section, it carried out similarly and the near infrared ray absorption laminate of the three-tiered structure of glass / resin / glass was obtained. The assessment result was shown in tables 1 and 2.

[0043] It sets in the example 3 example 1, and is a chemical formula. It replaces with the Lynn atom content compound shown by-izing 5 and \*\* 6, and is the following chemical formula. The Lynn atom content compound shown by 6 weight sections and \*\* 8 in the Lynn atom content compound shown by-izing 7 was similarly performed except having used 15 weight sections, and the near infrared ray absorption laminate of the three-tiered structure of glass / resin / glass was obtained. The assessment result was shown in tables 1 and 2.

[0044]

[Formula 7]  $\text{CH}_2=\text{C}(\text{CH}_3) \text{COO}-\text{CH}_2\text{CH}_2 \text{O}-\text{P}(\text{O}) \text{ and } (\text{OH})$  -- two [0045]

[Formula 8]  $[\text{CH}_2=\text{C}(\text{CH}_3) \text{COO}-\text{CH}_2\text{CH}_2\text{O-}]_2\text{P}(\text{O})-\text{OH}$  [0046] It changed into float plate glass in example 4 example 1, and the float plate glass (surface-electrical-resistance 4ohm/\*\*) which vapor-deposited silver on the front face was used for the electric conduction side, having carried out outside, and the near infrared ray absorption laminate with conductivity was obtained on both front faces. The assessment result was shown in tables 1 and 2. Moreover, the front face of a plasma display was equipped with this near infrared ray absorption laminate as it was. The assessment result as a front plate was shown in tables 3 and 4.

[0047] Carried out the laminating of oxidization silicon, a titanium dioxide, oxidization silicon, a titanium dioxide, and the oxidization silicon to the PET film (188 micrometers in thickness: Toyobo make) which carried out example 5 rebound-ace-court processing with vacuum deposition at order, the antireflection film was made to form, and the acid-resisting film was obtained. The following chemical formula The 0.1-% of the weight solution which diluted with the tetra-deca fluoro hexane the fluorine-containing shiran compound (the average degree of polymerization of about 5000 and a vinyltrimetoxysilane unit is the Daikin Industries, LTD. make, and number average molecular weight is 2) shown by-izing 9 was adjusted, and it considered as antifouling processing liquid.

[0048]

[Formula 9]  $\text{C}_3\text{F}_7-(\text{OCF}_2\text{CF}_2\text{CF}_2)_{24}-\text{O}(\text{CF}_2)_2-[\text{CH}_2\text{CH}[-\text{Si}-(\text{OCH}_3)_3]]_{10}-\text{H}$  [0049] After equipping with a mask film the opposite hand of the field in which the antireflection film of the PET film produced above was made to form, it was immersed into antifouling processing liquid, and this film was pulled up

and applied with 15cm speed for /. After spreading was left under the room temperature one whole day and night, vaporized the solvent, and made the pollution-control layer form in the front face of an acid-resisting film. The mask film was removed at the time of pasting with a laminate. The above-mentioned acid-resisting film with a pollution-control layer was pasted together to both sides of the near infrared ray absorption laminate obtained in the example 4, and the front plate for plasma displays was obtained. The assessment result was shown in tables 1-4.

[0050] According to the example 1 of a publication, the near infrared ray absorptivity glass plate was obtained to example of comparison 1 JP,4-214043,A. The assessment result was shown in tables 1 and 2.

[0051] According to the example 1 of a publication, the near-infrared absorptivity resin plate was obtained to example of comparison 2 JP,6-118228,A. The assessment result was shown in tables 1 and 2.

[0052] The acid-resisting film obtained in the example 4 to both sides of general-purpose acrylic resin (SUMIPEKKUSU 000 Sumitomo Chemical Co., Ltd. make) with an example of comparison 3 thickness of 3mm was pasted together, and it considered as the front plate for plasma displays. The front face of a plasma display was equipped with this front plate. The assessment result was shown in tables 1-4.

[0053]

[A table 1]

波長 (nm)	光線透過率 (%)							
	実施例					比較例		
	1	2	3	4	5	1	2	3
400	70	70	68	66	69	75	80	90
450	82	82	80	78	81	80	82	93
500	84	84	84	82	85	82	84	93
550	82	82	82	80	83	82	84	93
600	80	80	80	78	81	50	76	93
650	50	50	48	46	49	20	45	93
700	20	20	18	16	19	1	16	93
750	8	8	6	4	7	1	3	93
800	4	4	4	2	5	1	2	93
850	4	4	4	2	5	1	2	93
900	5	5	5	3	6	2	1	93
950	6	6	6	4	7	3	5	93
1000	8	8	8	6	11	5	8	93

[0054]

[A table 2]

	耐擦傷性	耐衝撃性 (重量／距離)	耐湿性
実施例 1	傷がつかない	1000g ／ 1200mm	変化無し
実施例 2	傷がつかない	1000g ／ 70mm	変化無し
実施例 3	傷がつかない	1000g ／ 1200mm	変化無し
実施例 4	傷がつかない	1000g ／ 1200mm	変化無し
実施例 5	傷がつかない	1000g ／ 1200mm	変化無し
比較例 1	傷がつく	200g ／ 300mm	白化
比較例 2	傷がつかない	200g ／ 300mm	白化
比較例 3	傷がつかない	200g ／ 300mm	変化無し

[0055]

[A table 3]

	視認性	リモートコントロール 試験 (m)
実施例 1	良好	1. 0
実施例 4	良好	0. 8
実施例 5	良好	1. 0
比較例 3	良好	1 0

[0056]

[A table 4]

波長 (Mhz)	遮蔽効果 (d B)			
	実施例			比較例
	1	4	5	3
3 0	0	5 5	5 5	0
5 0	0	4 9	4 9	0
7 0	0	4 5	4 5	0
9 0	0	4 2	4 2	0

[Translation done.]